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TO: Each Supervisor

FROM: Thomas L. Garthwaite, M.D.
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Jonathan E. Fielding, M.D., M.P.H.
Director of Public Health and Health Officer

SUBJECT: **WEAPON-RELATED INJURY SURVEILLANCE SYSTEM REPORT 1998-2004**

The attached report describes seven years of surveillance for firearm and stabbing injuries at four DHS hospital emergency departments and one rehabilitation facility.

If you have any questions or need additional information, please let either of us know.

TLG:JEF:yl

Attachments

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Weapon-Related Injury Surveillance System Report 1998-2004

Executive Summary

The DHS Injury and Violence Prevention Program has an ongoing surveillance system in place to monitor weapon related injuries at the four DHS emergency departments[1], and Rancho Los Amigos Rehabilitation Center. Three of the county hospitals are level 1 trauma centers and therefore patients with severe life threatening injuries are transported to these facilities.[2] Weapon related injuries such as those caused by firearms and stabbing injuries may be mild enough for treatment and release in the emergency department, moderate, or severe enough to require the specialized treatment available in a level one trauma center. This report summarizes the seven years experience of this system.

- Emergency department charges for persons treated in for weapon related injuries in 2004 amounted to more than $5.4 million.
    - $3.1 for firearm injuries.
    - $2.3 for stabbing injuries.
- In 2004, there were 1,639 visits for firearm injuries, a decrease of 29% from 1998.
- Firearm injury visits were most common among Blacks, males, and 15-34 year olds.
- From 1998-2000, 31% of firearm injuries were unintentional and 43% were assaults. In 2001-2004, 10% of firearm injuries were unintentional and 76% were assaults.
- In 2004, 59% of patients with firearm visits to the four emergency departments were admitted for inpatient treatment.
- In 2004 there were 2,384 visits for stab injuries, an increase of 3% from 1998.
- Stab injury visits were most common among Latinos, males, and 25-44 year olds.
- From 1998-2004, 65% of stab injuries were unintentional and 25% were assaults.
- In 2004, 44% of patients with stab visits to the four emergency departments were admitted for inpatient treatment
- These surveillance data may be used by public health, law enforcement, and social service agencies to monitor trends in violence and injuries related to firearms and stabbings to evaluate the effectiveness of violence and injury prevention programs and to identify gaps in coverage in prevention and intervention programs for intentional and unintentional injuries. Future reports will focus on comprehensive surveillance including hospitalizations, mortality, and emergency medical system data.

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[1] Harbor/UCLA Medical Center, LAC+ USC Medical Center, Martin Luther King/Drew Medical Center and Olive View Medical Center.

[2] LAC+USC, Harbor-UCLA, and Martin Luther King/Drew were level 1 trauma centers during 2004. During 2005, Martin Luther King/Drew lost its status as a trauma center.

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Weapon-Related Injury Surveillance System Report 1998-2004

Injuries from firearms and stabbings are a major cause of morbidity and mortality in Los Angeles County. In 2002, over one-third of the 4,084 injury deaths in the county were caused by firearms (1,277) and stabbings (112). During the same year, 2,698 persons were hospitalized for firearm injuries and 3,255 were hospitalized for stab injuries. Typically, injury surveillance relies primarily upon data obtained from death certificates and hospitalizations. These data are generally available after a delay of approximately 18-24 months. Under such a system, there is no mechanism for obtaining timely information about persons with less severe injuries that did not result in hospitalization or death.

To close this gap, the Injury and Violence Prevention Program initiated surveillance for weapon-related injuries among patients receiving emergency medical care at four DHS hospital emergency departments (Harbor-UCLA Medical Center [HUMC], LAC+USC Medical Center [LAC+USC], M.L. King, Jr/Drew Medical Center [MLK], Olive View Medical Center [OVMC]), and acute rehabilitation care at Rancho Los Amigos Medical Center (RLAMC). The surveillance system was initiated in February 2000; data collection was retrospective to January 1, 1998. This report summarizes data for January 1998 through December 2004.

Firearm injuries.
From January 1998 through December 2004, 13,908 emergency department and acute rehabilitation visits for firearm injuries were reported by five DHS hospitals (Table 1). The number of firearm injury visits decreased 10% from 1998 to 1999, increased 18% from 1999 to 2000, decreased 27% from 2000 to 2001, increased 4% in 2002 and then decreased 12% through 2004, resulting in an overall decrease of 29% (Figure 1). From 1998-1999, the greatest number of visits was reported by LAC+USC, and in 2000-2004 the greatest number was reported by MLK.

Table 1. Number of firearm injury visits at four DHS emergency departments and one DHS acute rehabilitation department, WRISS, Los Angeles County, 1998-2004.

	1998	1999	2000	2001	2002	2003	2004	Total
Hospital	No.	No.	No.	No.	No.	No.	No.	No.
HUMC	472	386	453	334	316	351	359	2,671
LAC+USC	923	849	899	449	426	335	307	4,188
MLK	847	770	1,030	906	1,005	955	861	6,374
OVMC	45	44	28	65	71	75	62	390
RLAMC	35	34	41	45	43	37	50	285
Total	2,322	2,083	2,451	1,799	1,861	1,753	1,639	13,908

In 2004, 1,589 persons made 1,639 visits for firearm injuries; 51% were Black and 43% were Latino (Table 2), 91% were male, and 77% were 15-34 years of age (Table 3). Multiple visits were made by 48 persons. Overall, the intent of the injury was reported for 90% of the visits (Table 4). Since 2000, assaults have accounted for about three quarters of injury visits and unintentional injuries for about 10%. In 2004, the average charge for a firearm injury visit treated only in the emergency department ranged from $821 at OVMC to $2,840 at MLK (Table 5). 41% percent of firearm injury patients were treated only in the emergency department. The average charge per visit for patients seen only in the emergency department was used to estimate total emergency department charges for all patients, which exceeded $3.1 million.

Figure 1. Weapon-related injuries at four DHS emergency departments and one DHS acute rehabilitation department, by year, WRISS, Los Angeles County, 1998-2004.

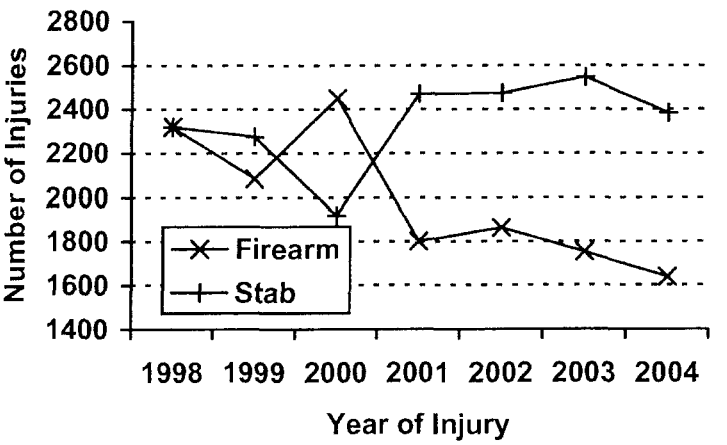

Table 2. Race/ethnicity of patients treated for firearm injuries at four DHS emergency departments and one DHS acute rehabilitation department, WRISS, Los Angeles County, 2004.

	Hospital											
	HUMC		LAC+USC		MLK		OVMC		RLAMC		Total	
Race/ Ethnicity	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%[1]
White	20	6%	7	2%	6	1%	6	11%	na	-	39	3%
Black	142	41%	69	23%	562	67%	8	15%	na	-	781	51%
Latino	152	44%	218	72%	259	31%	39	72%	na	-	668	43%
Asian	4	1%	6	2%	4	<1%	0	0%	na	-	14	1%
Other/Unk	29	8%	4	1%	3	<1%	1	2%	na	-	37	2%
Total	347		304		834		54		50		1,539[1]	

[1]Percents are based on the 1,539 patients treated in EDs that reported race/ethnicity.
na=Not available

Table 3. Age of patients treated for firearm injuries at four DHS emergency departments and one DHS acute rehabilitation department, WRISS, Los Angeles County, 2004.

	Hospital											
	HUMC		LAC+USC		MLK		OVMC		RLAMC		Total	
Age (years)	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%[2]
0-14	30	9%	17	6%	9	1%	0	0%	na	-	56	4%
15-19	84	24%	77	25%	195	23%	7	13%	na	-	363	24%
20-24	83	24%	91	30%	213	26%	19	35%	na	-	406	26%
25-34	84	24%	64	21%	249	30%	17	31%	na	-	414	27%
35-44	38	11%	38	13%	119	14%	8	15%	na	-	203	13%
45-64	27	8%	17	6%	47	6%	3	6%	na	-	94	6%
65+	1	<1%	0	0%	2	<1%	0	0%	na	-	3	<1%
Total	347		304		834		54		50		1,539[2]	

[2]Percents are based on the 1,539 patients treated in EDs that reported race/ethnicity.
na=Not available

Table 4. Visits for firearm injuries at four DHS emergency departments and one DHS acute rehabilitation department by intent[3], WRISS, Los Angeles County, 1998-2004.

	Intent of Injury										
	Unintentional		Self-Inflicted		Assault		Legal Intervention		Undetermined		Total
Year	No.	%	No.	%	No.	%	No.	%	No.	%	No.
1998	678	29%	10	<1%	955	41%	3	<1%	676	29%	2,322
1999	852	41%	14	1%	771	37%	7	<1%	439	21%	2,083
2000	618	25%	9	<1%	1,239	51%	13	1%	572	23%	2,451
2001	197	11%	12	1%	1,358	75%	10	1%	222	12%	1,799
2002	164	9%	4	<1%	1,389	75%	60	3%	244	13%	1,861
2003	168	10%	13	1%	1,340	76%	29	2%	203	12%	1,753
2004	144	9%	12	1%	1,297	79%	14	1%	172	10%	1,639

[3]External cause of injury codes were not reported by OVMC and RLAMC. External cause of injury codes were reported by LAC+USC after September 2000. For records without an external cause of injury code, the description of the injury was reviewed for keywords suggestive of the intent, i.e., assault, accident, suicide. If the description did not contain one of the keywords, the intent of the injury was classified as undetermined.

Table 5. Average emergency department charges[4] per visit for firearm injury at four DHS emergency departments and one DHS acute rehabilitation department, WRISS, Los Angeles County, 1998-2004.

Year	HUMC	LAC+USC	MLK	OVMC	RLAMC
	Average charge/visit	Average charge/visit	Average charge/visit	Average charge/visit	Average charge/visit
1998	$773	$860	$1,464	$567	na
1999	$968	$1,280	$1,076	$580	na
2000	$1,287	$797	$1,086	$371	na
2001	$1,046	$921	$1,856	$580	na
2002	$1,157	$837	$2,578	$434	na
2003	$1,143	$917	$2,988	$633	na
2004	$864	$1,058	$2,840	$821	na
Average	$1,029	$955	$2002	$585	na

[4]HUMC, MLK, OVMC, and LAC+USC after September 2000 all combined inpatient and emergency department charges when a patient was admitted after initial treatment in the emergency department. Thus, the average charge/visit was calculated using those patients who were only treated in the emergency department. For LAC+USC patients before and during September 2000, only emergency department charges were reported regardless of admission, so all patient records were used to calculate the average charge/visit.

Stab injuries. From January 1998 through December 2004, 16,394 emergency department and acute rehabilitation visits for stab injuries were reported by five DHS hospitals (Table 6). The number of stab injury visits decreased 17% from 1998 to 2000, increased by 33% by 2003 before decreasing by 6% in 2004. From 1998-2000, the greatest number of visits was reported by HUMC and in 2001-2004 the greatest number was reported by LAC+USC.

Table 6. Number of stabbing injury visits at four DHS emergency departments and one DHS acute rehabilitation department, WRISS, Los Angeles County, 1998-2004.

	1998	1999	2000	2001	2002	2003	2004	Total
Hospital	No.	No.	No.	No.	No.	No.	No.	No.
HUMC	1,301	1,087	811	796	764	855	775	6,389
LAC+USC	540	737	675	1,212	1,209	1,167	1,160	6,700
MLK	451	419	411	435	471	493	427	3,107
OVMC	29	34	21	26	30	30	20	190
RLAMC	2	0	0	1	0	3	2	8
Total	2,323	2,277	1,918	2,470	2,474	2,548	2,384	16,394

In 2004, 2,334 persons made 2,384 visits for stab injuries; 62% of the persons treated for stab injuries were Latino (Table 7), 76% were male, and 46% were 25-44 years of age (Table 8). Forty-six people made more than one visit for a stab injury. The majority of stab injuries were reported to be unintentional (Table 9). In 2004, the average charge for a stab injury visit treated

only in the emergency department ranged from $870 at LAC+USC to $1,233 at MLK (Table 10). 56% percent of patients with stab injuries were treated only in the emergency department. The average charge per visit for patients seen only in the emergency department was used to estimate total emergency department charges for all patients, which exceeded 2.3 million dollars.

Table 7. Race/ethnicity of patients treated for stab injuries at four DHS emergency departments and one DHS acute rehabilitation department, WRISS, Los Angeles County, 2004.

	Hospital											
	HUMC		LAC+USC		MLK		OVMC		RLAMC		Total	
Race/ ethnicity	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
White	107	14%	115	10%	5	1%	7	39%	na	-	234	10%
Black	119	16%	179	16%	221	53%	0	0%	na	-	519	22%
Latino	463	61%	783	69%	189	45%	9	50%	na	-	1444	62%
Asian	32	4%	48	4%	1	<1%	1	6%	na	-	82	4%
Other/Unk	38	5%	13	1%	1	<1%	1	6%	na	-	53	2%
Total	759		1,138		417		18		2		2,332[5]	

na=Not available
[5]Percents are based on the 2,332 patients treated in EDs that reported race/ethnicity.

Table 8. Age of patients treated for stab injuries at four DHS emergency departments and one DHS acute rehabilitation department, WRISS, Los Angeles County, 2004.

	Hospital											
	HUMC		LAC+USC		MLK		OVMC		RLAMC		Total	
Age (years)	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-14	124	16%	81	7%	21	5%	0	0%	na	-	226	10%
15-19	70	9%	136	12%	50	12%	4	22%	na	-	260	11%
20-24	110	14%	182	16%	68	16%	2	11%	na	-	362	16%
25-34	180	24%	290	25%	111	27%	6	33%	na	-	587	25%
35-44	138	18%	258	23%	94	23%	4	22%	na	-	494	21%
45-64	119	16%	179	16%	71	17%	2	11%	na	-	371	16%
65+	18	2%	12	1%	2	<1%	0	0%	na	-	32	1%
Total	759		1,138		417		18		2		2,332[6]	

na=Not available
[6]Percents are based on the 2,332 patients treated in EDs that reported age.

Table 9. Visits for stab injuries at four DHS emergency departments and one DHS acute rehabilitation department by intent[7], WRISS, Los Angeles County, 1998-2004.

Year	Unintentional		Self-Inflicted		Assault		Legal Intervention		Undetermined		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.
1998	1,435	62%	25	1%	540	23%	0	0%	323	14%	2,323
1999	1,622	71%	31	1%	459	20%	0	0%	165	7%	2,277
2000	1,101	57%	94	5%	544	28%	0	0%	179	9%	1,918
2001	1,569	64%	178	7%	671	27%	3	<1%	49	2%	2,470
2002	1,649	67%	145	6%	610	25%	7	<1%	63	3%	2,474
2003	1,735	68%	123	5%	606	24%	6	<1%	78	3%	2,548
2004	1,542	65%	152	6%	642	27%	2	<1%	46	2%	2,384

[7]External cause of injury codes were not reported by OVMC and RLAMC. External cause of injury codes were reported by LAC+USC after September 2000. For records without an external cause of injury code, the description of the injury was reviewed for keywords suggestive of the intent, i.e., assault, accident, suicide. If the description did not contain one of the keywords, the intent of the injury was classified as undetermined.

Table 10. Average charge[8] per visit for stab injury at four DHS emergency departments and one DHS acute rehabilitation department, WRISS, Los Angeles County, 1998-2004.

Year	HUMC	LAC+USC	MLK	OVMC	RLAMC
	Average charge/visit	Average charge/visit	Average charge/visit	Average charge/visit	Average charge/visit
1998	$546	$853	$1,245	$571	na
1999	$609	$1,170	$966	$525	na
2000	$794	$820	$905	$800	na
2001	$862	$832	$1,202	$516	na
2002	$807	$805	$1,383	$668	na
2003	$803	$811	$1,353	$816	na
2004	$1,056	$870	$1,233	$1,006	na
Average	$755	$868	$1,193	$681	na

[8]External cause of injury codes were not reported by OVMC and RLAMC. External cause of injury codes were reported by LAC+USC after September 2000. For records without an external cause of injury code, the description of the injury was reviewed for keywords suggestive of the intent, i.e., assault, accident, suicide. If the description did not contain one of the keywords, the intent of the injury was classified as undetermined.

Discussion

2004 is the seventh complete year for which WRISS data are available. During this time, there have been 13,908 visits for firearm injuries and 16,394 stab-related visits to county emergency departments and rehabilitation centers. MLK reported the greatest number of firearm injury visits, while the largest number of stabbing injury visits were reported at LAC+USC. The three level one trauma centers (HUMC, LAC+USC and MLK) accounted for the vast majority (>96%) of all weapons-related visits.

The age and gender of patients with firearm and stab injuries have not changed much during the seven years of surveillance. Overall, males accounted for 91% of patients with firearm injuries and 77% of patients with stab injuries. Firearm injury patients had an average age of 26 years while stab injury patients had an average age of 30. Race/ethnicity did vary over time, particularly for firearm injuries. Blacks accounted for a greater percentage of firearm injury patients each year from 1998 (36%) to 2002 (51%). The opposite was true for Latinos, who accounted for 55% of firearm injury patients in 1998 and 41% in 2002. In 2003, both of these trends reversed, with Blacks (46%) and Latinos (47%) each accounting for nearly half of all firearm injury patients. In 2004, the racial/ethnic breakdown of firearm injury patients saw a return to earlier years of surveillance, with 51% Black and 43% Latino. Among stab injury patients, the percent Black ranged from 20% to 26% and the percent Latino ranged from 55% to 62% during the seven year period.

Several patients made multiple visits to a particular hospital for weapons-related injuries. It is not possible to determine if the visits were for multiple injury episodes, or repeat visits for the same injury. To avoid counting the same individual multiple times among patient demographics, only the first visit for each patient during the year was used to calculate age, sex, and racial/ethnic distributions. However, the same person may still be included more than once in the demographic information if he received treatment at more than one facility. In particular, there was significant patient overlap between RLAMC and the other hospitals; in 2004, 60% of RLAMC patients were transferred for acute rehabilitation from one of the four other DHS facilities under surveillance. Because of these problems, these data can be used to measure the impact of weapon-related injuries on DHS facilities, estimate emergency department charges for weapon-related injuries, estimate the incidence of long-term sequelae of weapon-related injuries and spinal cord injuries (using RLAMC data), and quantify the demand for services related to these injuries, however, they cannot be used to estimate risk.

During the past seven years, the intent of firearm injuries treated in the 5 WRISS facilities has shifted significantly. Since 2001, about three quarters of all firearm injuries were classified as assaults. Prior to 2001, assaults were much less common, ranging from 37% to 51% of firearm injury visits. Some of this change can be attributed to a new data system implemented at LAC+USC in September 2000. The new system provided an e-code for each injury visit, which is likely responsible for the decrease in undetermined intent injuries in the later years of surveillance. However, unintentional injuries have also been decreasing. In 1999, 41% of all firearm injuries were unintentional, but between 2001 and 2004 only about 10% were unintentional. The reported intents of stab injuries, on the other hand, have remained more stable throughout the surveillance period. Assaults have accounted for roughly one quarter of injury visits each year while unintentional stabbings have accounted for about two thirds of injury visits.

By comparing WRISS data with hospital inpatient and fatality datasets, it appears that intent varies with the severity of the injury. During the most recent four years of surveillance, about 10% of firearm injuries were unintentional and less than 1% were self-inflicted. This is similar to intent patterns seen for inpatient hospitalizations[10]; however, in 2002, less than 1% of firearm fatalities were from unintentional injuries and about one fourth were suicides[9]. The intent of stab injuries also varies significantly by severity. Unintentional stab injuries are rarely fatal; in 2002 just 2% of stabbing fatalities were unintentional[9], while unintentional injuries accounted for 48% of inpatient hospitalizations[10] in 2002 and for about two thirds of ED visits during the seven

[9] Death Statistical Master File, Center for Health Statistics, California Office of Vital Records
[10] Hospital Discharge Data, Office of Statewide Health Planning and Development

years of surveillance. On the other hand, in 2002 assaults accounted for 73% of fatalities[9] and 30% of inpatient hospitalizations[10], while about one quarter of stab injury ED visits were assaultive during the seven years of surveillance.

At this time, the charge information reported by participating hospitals includes both emergency department and inpatient (if the patient was admitted) charges. Since inpatient charges are available from other sources, estimated emergency department charges were calculated for each hospital. In 2004, 56% of stab injuries and 41% of firearm injury patients were released after treatment in the emergency department. The average charge for those patients who were treated only in the emergency department was applied to the number of patients who were admitted for inpatient services to estimate total charges. Charges for firearm injury visits were estimated to be more than $3.1 million, and stab injury estimated charges exceeded $2.3 million. This is an underestimate of the actual emergency department charges. Prior to October 2000, LAC+USC reported only emergency department charges for all patients, regardless of admission status. The average emergency department charges for patients who were eventually admitted to the hospital were significantly higher than the charges for patients who were treated only in the emergency department. This was true both for stab (60% higher for admitted patients) and firearm (82% higher for admitted patients) injuries. When the estimated charges at each facility are adjusted for this increase, the 2003 total adjusted charges for firearm injuries exceed 4.5 million dollars and total adjusted charges for stab injuries exceed 3 million dollars.

The adjusted estimated charges reported above are far less than the total medical charges for all weapon-related injuries in Los Angeles County. The surveillance system collects charge information for only 4 out of 147 hospitals in the county, including just 3 of the county's 13 trauma centers. Other sources of medical charges include inpatient charges for more serious injuries and outpatient charges for patients not treated in emergency departments as well as follow-up and rehabilitative care. While the Office of Statewide Health Planning and Development provides inpatient charges, there is a substantial delay (> 1 year) in receiving the records, and these records cannot be linked to other data. The most useful surveillance system would be one in which records for emergency department, inpatient and outpatient medical care, and death records could be linked. This is not feasible with current injury surveillance systems in Los Angeles County.

Despite the large number of firearm and stab injury visits captured by WRISS, there are still significant limitations to the data collected. Different data and reporting systems used by the participating hospitals may result in different case ascertainment levels for each of the hospitals. In particular, the medical charges and intent of injury information should be viewed with caution, especially when making comparisons between hospitals. Not all facilities provided e-codes, so in some cases the intent of injuries were determined by scanning an injury description for key words (unintentional, accidental, assault, etc.). The accuracy of the total adjusted emergency department charges calculated above is not known. The adjustment is calculated using the difference in charges between non-admitted and admitted patients at one facility during the first two and a half years of surveillance. There is no way to determine if this accurately represents differences between non-admitted and admitted patients at other facilities.

The Injury and Violence Prevention Program will continue to conduct surveillance for weapon-related injuries at the five participating DHS hospitals. The surveillance data will be used to identify trends in violence and injuries related to firearms and stabbings, and to evaluate violence and injury prevention programs. The data in this report are most useful for analyzing hospital-specific and overall trends rather than direct comparisons between hospitals. The surveillance data can be used by Public Health, law enforcement, and social service agencies to

monitor trends in violence and injuries related to firearms and stabbings, evaluate the effectiveness of violence and injury prevention programs, and identify gaps in coverage in prevention programs for both intentional and unintentional injuries.